E FACTORISING EXPRESSIONS WITH FOUR TERMS

Some expressions with four terms do not have an overall common factor, but can be factorised by pairing the four terms.

For example,

$$\begin{aligned} &\underbrace{ab + ac} + \underbrace{bd + cd} \\ &= a(b + c) + d(b + c) && \{\text{factorising each pair separately}\} \\ &= (b + c)(a + d) && \{\text{removing common factor } (b + c)\} \end{aligned}$$

Example 11 **Self Tutor**

Factorise: $3ab + d + 3ad + b$.

Sometimes we need to reorder the terms first.

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Factorise: $3ab + d + 3ad + b$.

$$\begin{aligned}
& 3ab + d + 3ad + b \\
&= \underbrace{3ab + b} + \underbrace{3ad + d} && \{\text{putting terms containing } b \text{ together}\} \\
&= b(3a + 1) + d(3a + 1) && \{\text{factorising each pair}\} \\
&= (3a + 1)(b + d) && \{(3a + 1) \text{ is a common factor}\}
\end{aligned}$$

Sometimes we need to reorder the terms first.

Example 12

Self Tutor

Factorise:

a $x^2 + 2x + 5x + 10$

b $x^2 + 3x - 4x - 12$

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Self Tutor

Factorise:

a $x^2 + 2x + 5x + 10$

b $x^2 + 3x - 4x - 12$

a $\underbrace{x^2 + 2x}_{} + \underbrace{5x + 10}_{}$

$= x(x+2) + 5(x+2)$ {factorising each pair}

$= (x+2)(x+5)$ {$(x+2)$ is a common factor}

b $\underbrace{x^2 + 3x}_{} \underbrace{- 4x - 12}_{}$

$= x(x+3) - 4(x+3)$ {factorising each pair}

$= (x+3)(x-4)$ {$(x+3)$ is a common factor}

1 Factorise:

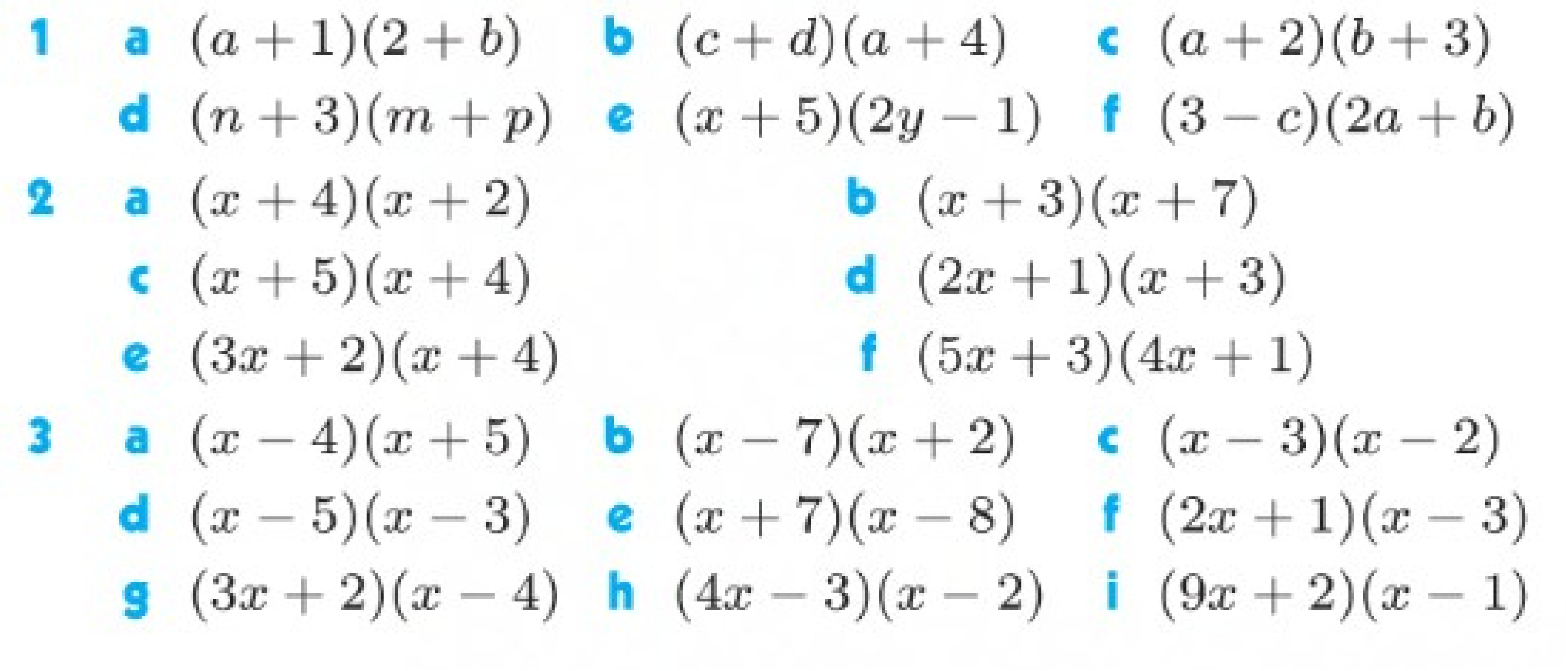
a $2a + 2 + ab + b$
b $4d + ac + ad + 4c$
c $ab + 6 + 2b + 3a$
d $mn + 3p + np + 3m$
e $2xy - 5 + 10y - x$
f $6a - bc - 2ac + 3b$

2 Factorise:

a $x^2 + 2x + 4x + 8$
b $x^2 + 3x + 7x + 21$
c $x^2 + 5x + 4x + 20$
d $2x^2 + x + 6x + 3$
e $3x^2 + 2x + 12x + 8$
f $20x^2 + 12x + 5x + 3$

3 Factorise:

a $x^2 - 4x + 5x - 20$
b $x^2 - 7x + 2x - 14$
c $x^2 - 3x - 2x + 6$
d $x^2 - 5x - 3x + 15$
e $x^2 + 7x - 8x - 56$
f $2x^2 + x - 6x - 3$
g $3x^2 + 2x - 12x - 8$
h $4x^2 - 3x - 8x + 6$
i $9x^2 + 2x - 9x - 2$



1 **a** $(a+1)(2+b)$ **b** $(c+d)(a+4)$ **c** $(a+2)(b+3)$

d $(n+3)(m+p)$ **e** $(x+5)(2y-1)$ **f** $(3-c)(2a+b)$

2 **a** $(x+4)(x+2)$ **b** $(x+3)(x+7)$

c $(x+5)(x+4)$ **d** $(2x+1)(x+3)$

e $(3x+2)(x+4)$ **f** $(5x+3)(4x+1)$

3 **a** $(x-4)(x+5)$ **b** $(x-7)(x+2)$ **c** $(x-3)(x-2)$

d $(x-5)(x-3)$ **e** $(x+7)(x-8)$ **f** $(2x+1)(x-3)$

g $(3x+2)(x-4)$ **h** $(4x-3)(x-2)$ **i** $(9x+2)(x-1)$